BIO-DYNAMICS

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COMPARATIVE SOIL TESTS 1951-1961 OF A BIO-DYNAMIC FARM

EHRENFRIED E. PFEIFFER

Previously, in BIO-DYNAMICS #59 (1), the yields of the N. V. Loverendale were reported. These showed a steady increase over a twenty-five year period of B. D. management. It is of interest to investigate the soil condition which was able to produce these results. It was not possible to make soil analyses every year, but we have received soil samples in 1951 and again in 1961, so that we could compare the conditions at the time when good average yields were the rule with those ten years later, when maximum yields were obtained.

These analyses were carried out at the Biochemical Research Laboratory, Spring Valley, N. Y., which does all the research work for the B.D. Farming and Gardening Association. The methods used for the determination of available nutrients are routine extraction with La Motte universal extracting solution and colorometric determination of nitrate, phosphate and potash. These results are expressed in lbs./acre. The determination of total nitrogen, phosphate and potash was done by the official methods of the AOAC (2). These results are expressed in % of the sample. Phosphate and potash are reported as P_2O_5 and K_2O.

The results are contained in the tables 1 through 4. Of the three farms of Loverendale (designated with the letters PH, TL and TM), three representative fields have been selected. The farm PH is located near Dinteloord N. B. on very heavy clay soil. The polder in which the farm is located has been under cultivation for some 300 years, and is by nature one of the very fertile sections of Holland. This polder was reclaimed from the sea and diked in about 300 years ago. Prior to B.D. management, this farm was intensively fertilized with commercial fertilizers, plus a reasonable amount of manure (10 tons farmyard manure/acre to sugar beets, once in a four to five year rotation). The crop rotation was: sugar beets, oats plus clover or alfalfa, clover or alfalfa, winter wheat (soft, red varieties), summer wheat or barley, caraway or flax, sugar beets or potatoes. Caraway or flax were grown because of their soil structure-improving quality. In more recent years, only flax has been used, which yielded regularly very well, was free of diseases, and paid very well. Instead of clover or alfalfa, other annual legume crops were also grown, such as field peas for seed and

beans (small, brown). The ground water level was rather high and somewhat regulated by pumping. In general, dry years resulted in better crops than wet years. The rainfall is fairly evenly distributed over the years, with maxima during late fall, winter and spring. The yearly average is about 35-40 inches. The climate is fairly cool and moist.

The farm measured 125 acres; it had only some 15 acres of permanent pasture; livestock of 14 to 16 dairy cows (Holstein, pedigree), a corresponding amount of young animals, 1 bull. Some breeding of heavy Belgian draft horses was done because there were champion stallions in the neighborhood. It was a typical sugar beet and grain farm, diversified in a fashion, and with good crop levels, slightly above the average of the area. The conversion to the B.D. method started in 1928. Ever since then, only farmyard manure has been used, set up in piles and B.D.-treated. The practice of giving 10 tons of manure per acre (mixed and composted, from all sources) to sugar beets or potatoes was continued, but no commercial fertilizer was bought. The gain is therefore due to the improvement of the manure quality. It is quite obvious that the B.D. treatment of the manure avoids nitrogen losses and raises the fertilizer quality of the manure. The livestock was fed mainly from products of the farm and very little concentrated additional feed was bought. During the first ten years, while this author supervised the management, there were never more than 6 lbs. of concentrates fed to high producing dairy cows; on the average only 3 lbs. Since this farm was one of the earliest with B.D. management, considerable experience had to be acquired with regard to crop rotation and conversion; mistakes were made, and the first years were rough, with irregular yields. Only after the initial experiences was there a more stabilized situation. The soils were very heavy, requiring special skill in their cultivation so as to achieve a crumbly structure, especially in wet years. The compaction of the soil when harvesting sugar beets in a wet fall is a terrible handicap. In spite of the good results obtained recently, the problem of the physical structure and compaction is not yet entirely solved. Sugar beets, with an average of 16-18% sugar, are such a good cash crop that the management has not yet decided to give up their cultivation.

The two other farms, TL and TM, are on the island of Walcheren, only a few miles from the coastline. These are lighter soils, partially sandy humus, partially sandy loam, but a few

fields of TL were extremely heavy clay and tight loam with poor drainage (TL-3). These two farms had the benefit of more legume crops, which always did well. TL had a typical grain rotation. Instead of sugar beets, fodder beets and mangels were occasionally grown with very satisfactory results.

Both farms were operated independently in the beginning, but after the World War II flood they were pooled together into one unit. The conversion of TL was started in 1930/31 and that of TM in 1934. Before the war, also a truck garden of 21 acres for vegetables and 2½ acres of greenhouses were maintained on TM. These were destroyed completely by the flood in 1945 and no attempt was made to rebuild them, except for one small house for table grapes. On TL there is also a bakery which produces from 7,000 to 10,000 loaves of bread per week from B.D. raised wheat — the famous Loverendale Whole Wheat Bread. There is also a grain mill, using old-fashioned grinding stones 4 feet in diameter.

The livestock intensity is similar to PH. The two farms together have about 204 acres of cropland and 50 acres of far away pastures (the latter not included in this report). Before conversion, they were average-yielding farms — nothing remarkable to report; in fact, TM which recently showed spectacular yields, was below average and a real Cinderella. However, it had never been misused for intensive production. The soils of TM were light, deep, sandy humus. The ground water level was and is high, but after the flood in 1945 better drainage and ditches improved the situation considerably. These farms could be considered typical of the old-fashioned diversified peasant farm. One reason for the spectacular yields recently obtained is certainly the fact that the very same peasant farm style management has been maintained.

It is this writer's opinion that, with regard to soil structure and profitable economy, as well as with regard to obtaining maximum yields at minimum cost, this type of management can still beat any streamlined grain factory. It is only necessary to maintain a suitable proportion between intensive grain land and legume growth, as well as pasture land, to produce enough manure and compost to become independent of additional fertilizer needs. Of course, even here one had to follow the modern trend of mechanization and reduced labor employment per acre, but on heavy wet soils, the old-fashioned, no longer possible, plowing

and cultivation with horses, though slow, had its advantages over tractor compaction.

Before the war, these two farms were doing all right, but nothing unusual could be reported — just good average in tune with the fertility and yields of the area. Maybe it is important to mention, however, that even then, after conversion, no more commercial fertilizer was bought, and especially that no nitrogen was ever needed. The greenhouses grew excellent and healthy crops, with no sprays, pests or diseases whatsoever and no renewal of soil. These greenhouses were used mainly for tomatoes, cauliflower, cucumbers and table grapes; during the winter occasionally chrysanthemums and tulips (Darwin and others) for cut flowers were grown. These were shipped to England and were much liked because they remained fresh for two weeks in the flower shop. When the inflation of the English pound sterling and the depression occurred in 1934, we had about one million cut flowers ready for shipment and we took a terrible beating.

The great event on these two farms was the day the Dutch pierced the dikes toward the sea and flooded the island in order to chase out the German army of occupation. The sea water flooded the land entirely and it remained flooded for 15 months. Commutation from house to house was by boat; the tides moved in and out daily. No plant life whatsoever survived. All the trees and windbreaks which had been planted with great care and effort perished. After the land was dried and drained it showed a grey, spongy surface. It was thought that it would take at least ten years to reclaim it. For a while, nobody but Loverendale planted trees and shrubs again, and even in 1950 the area of these two farms could be spotted immediately because of the trees growing again, while otherwise one could gaze 15 miles in any one direction over plain flat land.

The recovery took only five years and thereafter the development of these fields began to show spectacular increases in yield, which were reported in BIO-DYNAMICS #59 (1). As it was, the flood had washed away the errors of the past, the influences of fertilizers, and an ideal humus structure could be developed in due time. Without the diligent care of M. Steyn, the present director of Loverendale, (who has been with the company almost 30 years, who grew up there, started as gardener apprentice and learned to know the soils and to grow vegetables and an orchard and who finally took over the entire manage-

ment), and without the supervision and advice of Dr. Hans Heinze, with his many years of bio-dynamic farming consultation, all this would not have been possible. There was also a faithful and cooperative stock of local farm labor, some of whom lived on the farm and had cultivated the fields for 40 and more years and saw the previous as well as the new management. One of these old timers, very tight-lipped, was once asked, "What do you think now of bio-dynamic management?" "Well", he said hesitantly, after a few minutes' silence, "I see it grow".

After this description of the farm situation, we shall now discuss the results of the soil survey. There is first the somewhat startling discovery that all the soils had become alkaline. This is rather unusual, for the type of alluvial soils from river deposits of hundreds of years ago tend to be acid. But because these soils were reclaimed from the sea, they are penetrated by shells of crustaceæ, which also explains the high calcium content. Nevertheless, no alkaline or saline damages could be found, even though winds and storms blew a lot of seamist over the land because of the proximity to the coastline. Only in the market garden and greenhouses which had water sprinkling systems, did we notice an increase of chlorine to 0.1% (NaCl). We introduced and preferred, from then on, underground irrigation, and no more problems arose. The alkalinity is "biological", for all humus-forming organisms in compost and soil tend to produce an alkaline reaction. In fact, in bio-dynamic treatment of composts and manures, we try to stay away from acid humus because of its instability, its leaching out, and the danger of very dangerous "bog iron" (or a calcareous-iron-humus compound), which is very toxic to roots. The organic matter levels, according to our standards, with 2.5 to 3.0%, are moderately high. There is, however, a difference between the organic matter of PH and the two other farms, TL and TM. (See Table 1.)

PH is an old soil of hundreds of years of cultivation. PH 1 has been, as far back as we can ascertain, but at least for 50 years, permanent pasture. It shows, therefore, the very values of a fertility which has been preserved. In a way, this represents the standard reference situation against which losses or increases or maintenance can be measured. The two other soils of PH can be compared with this reference soil and tell of the still good but nevertheless reduced level because of intensive cropping.

The organic matter of TL and TM has been built up since

1945, for at that time the flood had destroyed all life. It is now very interesting to see two soils of TL (3 and 7) improved, while TL 12 declined. This field, after sods were plowed under, was intensively cropped and is apparently very sensitive to humus losses because of exposure. The reason for the drop in organic matter of TM 4 is entirely different. Here we have an orchard in good condition which, in recent years, because of the shade from the trees, was not well aerated and also did not receive enough compost.

The figures for nitrate, with a few exceptions, are moderate and show only insignificant fluctuation between 1951 and 1961. They are supposed to indicate nitrification and nitrate availability to roots. But there does not appear a relationship to the crop levels of the various fields or an explanation of the increase over the last 10 years. In fact, one field with 20 p.p.m. did not yield more or less than others with 36 p.p.m.

The figures for ammonia show a very slight increase. In bio-dynamic soils we usually find no free ammonia. We prefer well-aerated soils, for with them nitrate formation has a better chance. Ammonia shows up either after fresh manure has been applied or after the use of ammonia fertilizer. Neither reason appliés here. Ammonia, under the management as it was, is a sign that excessive nitrogen may be present, so that under wet and somewhat anaerobic conditions ammonia "spills over".

It is for that reason — because the nitrate and ammonia levels did not show a relationship to the yields and manure application — that we decided to run tests for total nitrogen. These were done using a standard method (micro-Kjeldahl). The results were, to say the least, interesting and surprising. The total nitrogen content ranked between .18% and .48%, most frequently near .22%. In terms of lbs./acre, counting the 6″ deep topsoil as 2,000,000 lbs., this means between 3,600 and 9,600 lbs./acre. The highest value was found on the pasture which we know had been so used for at least 50 years, probably much longer. This soil we might consider the "reference" soil, not touched by plowing and harvesting and closest to a virgin condition. All other soils were more or less heavily used arable cropland. The original reference soil had a nitrogen content as one frequently finds in wet farmyard manure and garden- or farm-made composts. This total nitrogen is present in the organic matter of the soils, in the so-called humus, a stable humus, not humic acids or acid humus which can be washed out and would

run off the field with every rain. The water coming out of the drain tiles and collecting in the ditches is clear; we might therefore call this humus unerodable. Much of this matter is present in the form of protein and other complex compounds of the living cells of soil organisms. Some of it is in form of the breakdown products, but the living process of nitrification and of weathering provides enough nitrogen in available and root-acceptable form, so that on these fields no nitrogen deficiencies show up and the phenomenon of tied down nitrogen (temporarily tied down, as it was) occurs only for short periods of very wet conditions. The yields reported in BIO-DYNAMICS #59 certainly do not indicate nitrogen deficiencies. This is a strong point for the efficiency of a properly applied B.D. treatment of manures, composts and soils — namely that for these no nitrogen problem exists. This experience we have had on many B.D. farms abroad as well as in this country. The point is to "grow" nitrogen; that is, to maintain such conditions that nitrogen fixation is a natural "crop" underneath the soil surface. "Feed your soil (3) and your soil will feed your plants" is a phrase from an article written by Lyle Wynd some years ago. The maintenance of such a soil life as will supply a sizable nitrogen reserve, made available at the growing period of crops, with a steady release, is one major aim and achievement with proper application of B.D. practices. On the farms about which we are reporting, no nitrogen fertilizer was bought during this observation period of 25 years. We do not deny the truth of the fact that nitrogen is a major fertilizer element for obtaining good crops and yields, but we just go about it in a different way than common agricultural thinking believes it must be done.

In literature and textbooks, one finds mentioned as a rule of thumb that usually 5% of the total organic matter of a soil (in lbs./acre) is present as nitrogen. Using this rule as a measure, we can calculate how many lbs./acre of nitrogen should or could be present in these soils of Loverendale. The table on nitrogen (Table 2), therefore, contains as a last figure the "theoretical" amount of nitrogen, which ranks, with one exception (TM 1) lower, and frequently much lower, than the actual findings; for instance, the "reference" soil had 9,600 lbs. of nitrogen per acre. According to its 4.3% organic matter, using the 5% rule, it would have 4,300 lbs./acre. Of great interest is that the orchard soil (TM 4) with its low organic matter of 1.8% should have, theoretically, 1,800 lbs. of nitrogen per acre but, in reality,

has 4,000 lbs./acre. We see, therefore, in this and most other soils, that there is an abundant reserve and that these soils are really saturated with nitrogen, even under conditions where heavy cropping, including one year of sugar beets or potatoes, two to three years of grain, and a rest period of only two years of clover or alfalfa in the crop rotation, is maintained. This process of *growing* nitrogen makes it worth while using the B.D. method.

In discussing the soil analyses for available phosphate and potash and total phosphate and potash, the very same observation was made, namely, that these soils had, according to the common fertilizer concept, reasonably satisfactory amounts of available phosphate and potash per acre (see Table 3) but that the reserves in the form of total phosphate were, in most cases, more than ten times as much as the available figures in terms of lbs./acre. Total phosphate and potash were determined according to standard methods of analysis. In the case of potash, this is quite a tedious method. With regard to potash, the actual figures of available lbs./acre are sometimes not in any direct relationship to the actual total amount per acre. Our reference soil (PH 1), for instance, had a relatively low available potash (190 lbs./acre) but an extremely high reserve of 2.3% or 46,000 lbs./acre. Other soils (PH 4 and 5) had a reserve of 1.3% (26,000 lbs.), while another field of the same farm (PH 19 and 20) had 1.8% (36,000 lbs.) at the same level of 180 lbs./acre of available potash. Again, the point is that these soils were heavily cropped and that the task is to establish and maintain such biological conditions that one can draw on the reserves. No potash fertilizer was bought over the reported period of 25 years.

The question may be raised, how long will these reserves last and are there natural processes which may replenish these reserves. So far, the turning under or composting of crop residues and the manuring of the fields within the limits of crop rotation seemed to be satisfactory. So far, the maintenance of the organic and biological conditions helped in the skillful use of the reserves. Soils which were over-intensively used by grain cropping without rest periods showed lower reserves but were still abundantly provided with available and total potash. We know from experience that green crops especially, make heavy demands on potash, and we found elsewhere that one of the weak points of many organic farms with greenland management, alfalfa, grass and clover was that they were low in available pot-

ash. We are not dogmatic in this regard and would not refuse to apply supplementation where necessary, but we would prefer such supplementation by means of lasting resources as long as the natural biological process can make them available — for instance, by using certain potash-containing rock rather than by water soluble and therefore easily washed out salts. If necessary, we would not refuse potash-magnesia and/or potash rock (certain granites, for instance Hybro-Tite) which can be rendered available.

The same applies to phosphate. The rules are to avoid tying down. An alkaline rock phosphate applied to an alkaline soil will not become available unless there is such soil life or microorganisms which can convert it. This problem, unfortunately, has not been investigated as yet. Easily available, acid phosphates are frequently tied down and become unavailable as soon as they hit the soil. Only 10% of these may remain usable on the average. Again, the biological condition of the soil decides which way the process will turn. With regard to phosphates, we see that most soils of this report were well provided with phosphate reserves and that 25 years of B.D. management has not yet exhausted them. On heavy clay soils under wet conditions, with occluded surfaces, we see that making phosphate available may be a problem. In order to work with and not against the biological-organic process, we feel it is preferable to enrich the manures and composts with natural phosphates. This has been done a few times on a few fields of TL by adding a small amount of phosphate to the barnyard manure and should definitely be done on PH 4 and 5, PH 19 and 20 and TL 3. It should be done in reasonable amounts, for instance 50 lbs. per ton of manure, but certainly not in any excessive amounts; that is, using just as much as the biological conditions allow it to "digest".

Little can be said in this report about calcium and magnesium, both of which seem to be present in abundant amounts, so that there is only the problem of rendering them available or exchangeable. It may be noteworthy that this goal has been reached in almost all the soils of Loverendale. It is also obvious that the high exchange figures obtained by 1961 express an optimum or stabilization rather than absolute values. A proportion of calcium to magnesium of 3:1 or 2:1 is considered to be well-balanced, so that no calcium damage will show up. Most of these soils are close to this balance. (See Table 4).

With regard to trace minerals, we did not find trace mineral

deficiency symptoms in the leaves of plants. The analysis for available minerals shows that manganese seems to be somewhat of a problem, that is, apparently it is tied down. Boron is on the low edge, but alfalfa did not show leaf symptoms of its deficiency, and copper, though low, was abundantly provided.

Summarizing, it may be said that basically the soils of Loverendale did not fare badly over the period covered by the report. However, there was and still is the problem that the heavy clay soils are extremely sensitive to excess moisture and still offer problems of aeration and cultivation. Using the law of the minimum in a universal way, including all factors of life and growth and not only the limited N-P-K concept, it is this writer's opinion that structure and surface occlusion problems, as well as drainage and water circulation, could still be improved. These are the "minimum" requirements — that is, as regards physical conditions — to which attention needs to be paid. But this is a matter of soil management and crop rotation and not of fertilizer application. With regard to yield and utilization of reserves, the lighter soils responded much more quickly to treatment than the heavier soils.

Table 1. *Structure, Color, pH and Organic Matter.*

Farm & Field #	Structure and Color	pH 1951	pH 1961	Organic Matter % 1951	Organic Matter % 1961
TL 3	loamy, compact, clay light brown, heavy	7.9	7.8	2.7	3.4
7	sandy loam, compact, gray	8.0	7.7	3.0	3.8
12	loamy, medium heavy, compact, brown	7.9	7.8	4.2	1.9
TM 1	loamy, friable, grey-brown	7.9	7.7	—	3.7
4	Boomgaard, clay, loamy, brown-grey	7.8	7.8	3.5	1.8
6	loamy, compact, grey-brown	7.9	7.7	2.5	3.8
PH 4 & 5	loamy, friable, brown	—	7.8	—	2.7
19 & 20	loamy, friable, brown	—	7.6	—	2.3
1 pasture	sandy loam, compact, dark brown	—	7.7	—	4.3

Table 2. Nitrogen

Farm & Field #	Nitrate 1951	Nitrate 1961	Ammonia 1951	Ammonia 1961	Total Nitrogen 1961 %	Total Nitrogen 1961 lbs./acre	Nitrogen 1961 as 5% of O. M. in lbs./acre
TL 3	16	20	trace	3	.19	3800	3400
7	24	20	trace	3	.25	5000	3800
12	20	12	trace	3	.22	4400	1900
TM 1	16	16	trace	4	.18	3600	3700
4	32	40	trace	5	.20	4000	1800
6	35	56	trace	2	.24	4800	3800
PH 4 & 5	—	52	—	2	.22	4400	2700
19 & 20	—	36	—	3	.20	4000	2300
1 pasture	—	48	—	2	.48	9600	4300

Table 3. Phosphate and Potash

Farm & Field #	Available Phosphate—lbs./acre 1951	Available Phosphate—lbs./acre 1961	Total Phos. 1961 as P_2O_5 %	Total Phos. 1961 as P_2O_5 lbs./acre	Available Potash—lbs./acre 1951	Available Potash—lbs./acre 1961	Total Potash 1961 %	Total Potash 1961 lbs./acre
TL 3	175	200	.075	1500	350	200	1.45	29000
7	200	400+	.225	4500	350	190	1.24	24800
12	150	300+	.150	3000	180	220	1.60	32000
TM 1	—	400+	.175	3500	220	220	1.32	26000
4	200	400+	.150	3000	260	230	1.94	38800
6	200	300+	.200	4000	220	200	1.42	28400
PH 4 & 5	—	150	.100	2000	—	180	1.3	26000
19 & 20	—	150	.125	2500	—	180	1.8	36000
1 pasture	—	300	.325	6500	—	190	2.3	46000

Table 4. Exchange Calcium, Magnesium, Manganese, Boron, Copper

Farm & Field #	Calcium lbs./acre 1951	Calcium lbs./acre 1961	Magnesium lbs./acre 1951	Magnesium lbs./acre 1961	Manganese lbs./acre 1951	Manganese lbs./acre 1961	Boron p.p.m. 1961	Copper p.p.m. 1961
TL 3	4000	5600	300	1500	0	0	5	2
7	3500	5600	300	1500	0	low	4	2
12	1800	5600	350	1500	0	0	4	2
TM 1	—	4400	—	1500	0	trace	2	2
4	4000	5600	300	750	0	trace	2	2
6	3000	2800	trace	600	0	0	4	1
PH 4 & 5	—	5600	—	1700	0	trace	5	2
19 & 20	—	5600	—	1500	0	trace	4	2
1 pasture	—	5600	—	1500	0	0	6	2

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BIO-DYNAMICS AND ECOLOGY

ERNST F. WINTER

It is now thirty-seven years ago that Dr. Rudolf Steiner delivered his *Agricultural Course* at Koberwitz. What was then an isolated instance of a fresh approach to and a new outlook on Nature and Man's relationship to Nature, has increasingly become the scientific preoccupation of many in different lands. Recent developments in man's so-called mastery over Nature have led to a point of crisis — dust storms, floods, erosion, pollution, pests, diseases, etc. — where survival or at least healthy human existence depends on the drastic awareness by scientists and the general public that Man is a part of a complex environment which must be appreciated, studied and treated as a whole, and modified only with loving and scientific care.

B.D. gardening and farming practices have always been inspired by such a concern. Surveying some of the many and varied life-giving and life-sustaining experiments by members of the B.D. movement in many different lands, one is struck by the fact of how the experiences and observations of such isolated witnesses to a new type of agriculture are rapidly being incorporated into the present-day commercial, so-called modern farming techniques. In the Soviet Union, for example, *Bio-Dynamics* seems not only to be read, but also some of its proposals seem to have been incorporated into public agrarian policy. An increasing number of agricultural experts and students from the so-called underdeveloped countries are beginning to look to the West for more information as regards "scientific organics". But, perhaps the most encouraging signs of all, from the B.D. viewpoint, are the recent developments in the *science of ecology*. Ecology has always been an integral part of B.D.

Ecology is a term increasingly being batted about. Today ecology means the science dealing with the relationships of all living organisms among themselves and with the world surrounding them. It has become the all-comprehensive biological science of environmental interrelations. It may easily become tomorrow the key science of Nature. Although especially in Chinese thought, but also in the writings of Hippocrates, Aristotle and other ancients, material clearly ecological in nature can be found, the recognition of the problem and the term itself are of recent vintage. The German scientist and popularizer of Darwin on the continent, Ernst Heinrich Haeckel (1834-1919) coined it in 1866 in his *General Morphology*. Accordingly, it is the study

of organisms "at home". By 1900 Swiss, Danish, English, American, German and Russian scholars had developed all the rudiments of a science of ecology. But it took the man-made natural catastrophes of the decades of the mid-century to call forth a spate of research and summation. Among those pioneering studies we find also Dr. Pfeiffer's *The Earth's Face and Human Destiny*, 1947. The contemporary synthesis of observations, experiments and ideas is producing unifying principles, giving the science of ecology a definite form. Widely respected authorities have written valuable studies and handbooks. (For some recent publications in this country see: M. Bates, *The Forest and the Sea*, a look at the economy of nature and the ecology of man, N. Y., Random House, 1960; A. H. Benton and W. E. Werner, *Principles of Field Biology and Ecology*, N. Y., McGraw-Hill, 1958; J. R. Carpenter, *An Ecological Glossary*, N. Y., Hafner, 1956; E. P. Odum, *Fundamentals of Ecology*, Philadelphia and London, Saunders Co., 1959; P. B. Sears, *The Ecology of Man*, Eugene, O., Oregon State System of Higher Education, 1957; J. H. Storer, *The Web of Life*, N. Y., Devin-Adair, 1959; UNESCO, *Human and Animal Ecology*, 1957.)

Obviously, the science of wholeness has become so complex that even ecologists have become specialists. The environmental factors that must be studied, such as physical factors, the nature and texture of the soil, moisture, temperature, air, wind etc. contribute to specialization. Multifarious are the effects plants and animals exert upon each other. Thus one speaks of plant ecology and animal ecology. It may be the study of one individual of a species (autecology) or of all members of a species (population ecology), or the entire complex of species in a locality (community ecology). The latter is the ideal of ecological studies, namely to aim at a comprehension of the whole which is more than the sum total of its parts. It is possible to abstract ecological systems (ecosystems) in the world or cosmic environment, representing the highest level of complex integration. There is talk today of training *space ecologists* who will buckle themselves into the seat of spaceships and control a ship's life-sustaining system. Their knowledge of both biotic communities and abiotic environment will have to be vast, on the gigantic scale of an ecosystem. In each instance, however, ecology studies the abiotic substances, producer organisms, consumer organisms, reducer (decomposer) organisms and their interrelations. The biogeochemical cycles, as for example of nitrogen, illustrate how

relatively perfect and self-regulating Nature is. The humification and mineralization of the soil through bacteria is another example. Even insignificant penicillium, it is being discovered, has its own ecology. Not only does it secrete a substance inhibiting the growth of bacteria — a fact man utilizes to combat pathogenic micro-organisms — but frequently also the victim (bacterium) fights back, producing an anti-fungus substance, thus creating the relation of competition and worsened pathogenic phenomena. There is much still to be learned about the ecology of antibiosis. Any current list of diseases, parasites, insect pests etc. ought to teach man to beware of new negative interactions and to avoid sponsoring these. Nature is almost violent, certainly prodigious in her will to establish dynamic climaxes. The study of paleoecology, i.e. the operation of ecological principles throughout various geological periods, seems to prove the existence of consistent "laws of nature". The climax concept in ecology signifies a community self-perpetuating and in equilibrium with the physical habitat. Man's past modifications of a climax often ended in a disclimax and attendant disasters. Knowledge and education in ecology could certainly lessen these occurrences in the future.

It has been one of the most satisfying fascinations of people actively involved in what can be broadly termed "organics" that they have been *amateur ecologists*. Who has not made striking observations? My own children "discover" annually in late spring that the big snapping turtles on our homestead have clearly demarked feed and egg-laying ranges; that various birds battle with song, wings and claws in defense of their feeding and nesting areas; that various warblers possess different height layers in the woods and do not intrude up or down into "foreign" space. In our upset time, to observe and live within a balanced piece of Nature is indeed an encouraging and strengthening experience. How many "natural areas" will be conserved for future generations? It is important to save and preserve samples of natural communities for comparison with modified areas, in order to be able to continue to learn ecologically.

The rigorous *scientific ecologists* have made the exhilarating study of such phenomena their life's work. If we heed their findings, future generations will indeed live in "natural" environments. The ideal balanced life community has been found to exist in untampered fresh waters. The study of ponds, lakes, rivers is known as limnology. The microcosm of a lake teaches

the complex interrelationship of the many parts of Nature. Marine ecology is another such field. Plankton is an example of community ecology with biotic potential, reminding us of the enormously long food chain in the ocean. Terrestrial ecology displays the most variable habitats. Various types of forests and prairies constitute ideal terrestrial habitats for the study of balance and order in Nature. Some of the largest land community units (biomes) convenient to classify and recognize are: tundra, northern coniferous forests, temperate deciduous forests, broadleafed evergreen subtropical forests, grassland, desert, chaparral, piñon-juniper, tropical rain forest, mountain zones etc. The United Nations is pursuing important studies of the ecology of Africa. On their outcome will depend to a large degree the future of that continent. Of course, one of the most fascinating habitats to husband and study on our B.D. homestead, are the compost piles. They are a lesson in life! Understanding that lesson makes for good composts. Agricultural experiment stations are now advocating ecological practices when advising strip cropping of alfalfa fields, in order to preserve the field's biotic community and thus maintain biological control of pests.

While this science of ecology is first of all analytic and descriptive, it is obvious that it arrives at certain principles and applications. Among the principles so far discovered and elucidated we find the most potent one the certitude that Nature is dynamic. Nature is constantly involved in restoring balances. Everybody has observed how vegetation will grow back after the abandonment of formerly cultivated land; how the pond population of a new pond differs from an older one. Secondly, the natural economy in ecology is a diversified one and not a monoculture. Moreover, diversification is based on certain companion plants and animals. Thirdly, there exist food chains, ecological pyramids of numbers, biomes and energy principles akin to the two laws of thermodynamics. Fourth, natality, mortality and population increase or decrease are proportionate to biotic potential, environmental carrying capacity and resistance, and subject to cyclic oscillations. Finally, organizationally, the major and minor biotic communities follow the laws of ecological dominance, succession, climatic and soil-conditioned climax.

Applications of these principles to natural resources, their proper exploitation and preservation, were the first and most obvious uses to which ecology was put. The Ecological Society of America, the Audubon Society, Wilderness Society, Nature

Conservancy, National Park Service, Friends of the Land, Organic Gardening and Farming, Biodynamics, Balanced Living and the like are proud accomplishments this country has pioneered. However, one must not rest on laurels. The renewed establishment and maintenance of natural areas, wildlife refuges; a widespread popular concern for land uses, air and water pollution management, rangeland and national forest management and the like could be very successful today, and could save vast areas of the United States from blight and ruin, because the ecologists have been trained and are available. Men too wise to tolerate hasty tinkering with the gadgets of our age, accept without a qualm the most radical interferences with our biotic environment!

A second and more recent application can be found in the field of public health and welfare. Rural sociology, the ecology of cities, rat population control, national disease controls etc., testify to the problems. Again, there are no reasons for relaxation, because some applications seem successful. The problem has not only become national, but global, bracketing everything from world hunger and sickness, to domestic cancer, heart disease, polio etc., and practical schemes to be carried out by the Peace Corps at home and abroad. Ecologists are increasingly available for use by public authorities.

A third and very recent application of ecology is to human society. Together with political ecology, a detailed analysis of both being outside the scope of this introductory paper on ecology, they promise great potential. Human ecology is the population ecology of man. Its primary lesson here is to emphasize that the careful study of and cooperation by man with natural cycles, rather than wholesale tamperings, especially for commercial gain, beyond our ability of comprehension, is absolutely necessary if we are to achieve a happy and sane orderliness in man's relation to man. Men hurt men often through those man-made catastrophes which have their origin in the application of ecologically *unsound* practices. Ecology has supplied the scientific evidence that plants and animals are interrelated in highly complex natural communities. Consequently, they must be handled with greatest scientific care.

Obviously, the implications of these principles and their applications become especially weighty, when we, as we must, include an ever growing world population in our reckonings. Man is in the paradoxical position of being part of Nature and

yet being also above and outside it, due to his rational intelligence. Conclusions to be drawn and decisions to be made, set man clearly above the environment of which he has been and will remain to be such a fatefully integral part. How to achieve a stable biotic community with man as a member is certainly the most important single question ever to face any branch of applied science. It is here that my fascination with ecology as a social scientist really finds no bounds. The Human Factor looms larger and larger. There are only a few examples left, where man is a member of Nature. In 1946 I lived for a short while with such a people, the Negritos of Northern Luzon in the Philippines. These pygmies were in an equilibrium with their environment. They constituted a climax organism together with their environment. But, of course, most men have become completely "emancipated", pioneers versus Nature.

The problem of lasting versus temporary relationships with Nature has already been beautifully described in the 6th century B. C. by the Chinese sage Lao Tzu. Tao, the great order, shows the way to inner and outer harmony for man. Many Asians have heeded this philosophy. Western man too has had his periods of contemplation. In general he has been, however, more active, a "Kulturmensch". Therefore, an answer to modern man's meaningful integration into the cosmic as well as terrestrial order will take into account man's conscious and rational knowledge concerning this order. It can be the cooperative task of many sciences, especially the biological, social and physical ones. The dynamic balance will have to be repeatedly struck anew. This is a gigantic task. It is also the price we have to pay for not being satisfied with the life of a Negrito. There is no turning back, but only a conscious going forward. Human ecology, i.e. individual man and the balance of nature, as well as, what I like to call *political ecology*, i.e. society and the balance of nature, are fledgling sciences with an important future. Man's industrialization of agriculture is the end of ecology and the eventual end of man. Man's conscious ecological living can be the beginning of a new era. Plant and animal diseases, nutritional deficiencies are the rapid fire answers of a desperate Nature seeking to restore a balance by wiping out man-induced foreign bodies.

Should it be the irony of history that man by disobeying ecology and artificializing his life and environment is signing his own warrant for elimination? Certainly it seems that Nature

is doing everything it can to be just one step ahead in the destruction of "unnatural" life. We don't ask what is the natural habitat of a plant and an animal, and how we can husband both so their returns for us will be health-sustaining and life-giving. Rather, we figure in commercial terms of return, of bushels per acre and pounds on the hoof. True, man's culture will continue to modify the environment even in an ecological age. But Nature will not be basically hurt, will thus not wildly fight back, but will patiently teach us to accept a mutually satisfactory ecologically dynamic adjustment. In economic terms, here are the two ecological choices: *diversified agriculture on a large scale with a large manpower* or *diversified agriculture on a small area with small manpower.* Peasant societies before population explosions accomplished the latter. Under no circumstances can ecology be furthered in large, manpower depleted monocultures.

American universities have pioneered in the study of ecology. The ecological conscience must not remain the unique and sole possession of all those practicing "organics" and especially B.D. Here, in ecology, may be found for some of the children of us practitioners, but also for the children of a dwindling farm population and a peasantry fleeing their state of life, and for those of a wide-eyed urban population, the very profession which will bring them personal happiness and a meaningful life in the service of sanity and survival for the many values of our society.

BOYS TOWN

While there are outstanding exceptions to this "rule", as there are to all generalizations, it's very frequently the case that good farmers aren't given to talking much. That is one reason why your editors have such a problem in getting reports from farmers and gardeners about their results with Biodynamics. We know they're there, plenty of them, scattered around in the extensive geography of the U. S. A. We even know them personally. But getting them to tell us their experiences for publication — well, as Virgil (who incidentally was intelligently interested in farming too — read the *Eclogues* some time in translation or the original if you never have) as Virgil said in another connection, "Hic opus hic labor est", "That is the toil, that the labor".

So on occasion we like to sneak up on these good farmers if it means that even indirectly we can let you know what is going on. And in the August 1961 issue of THE NEBRASKA HOLSTEIN NEWS there was an interesting advertisement for some cows that were being offered at the Nebraska State Sale on August 18th. We reprint the advt. here because we think it will be of some interest to readers of Bio-Dynamics. The seller is an institution known to just about everybody in the U.S.A., while tucked away in their advertisement is one of the most realistic, practical appreciations of B.D. that we have seen in a long time.

We merely add, for the record, that the big farm operated by Father Flanagan's Boys Home, Boys Town, Nebraska, has been using the B.D. Starter and following Dr. Pfeiffer's B.D. advice for three years now. They currently treat all their manure biodynamically. As to the results, in terms of fine cattle, we refer you again to THE NEBRASKA HOLSTEIN NEWS. Here are some excerpts from their news pages in the same issue:

Nebraska District and All-State Black and White Shows — 1961, page 5 : "Junior Champion Female was Boys Town Tessy Maestro (at the Northeast District Show). Shown by Father Flanagan's Boys' Home, this senior yearling Wis Maestro daughter had all the style, cleanness and balance you could want. She placed third in a strong All-State Show late in the week. Boys Town had the second place Senior Heifer Calf, first and second place Senior Yearling . . . This spelled a winning Junior Get!" . . . "Boys Town Raven Burke Ideal daughter . . . was placed in the purple ribbon division."

The All-State Show (page 8): "With 27 entries in the senior calf class, Boys Town stood first and fourth with their Skokie Creation Roamer daughters." (Boys Town Rose Creation).

Top H.I.R. Records (page 20): Pay Line Bea Beauty Imperial of Father Flanagan's Boys Town placed second with 3x daily milking 365 days 22,274 lbs. of milk and 839 lbs. of butterfat. (Considering that this cow is 9 years old, this is quite a remarkable record.) A 6 year old cow, Siouxland Queen K Rocket of Boys Town with 3x milking in 328 days produced 16,453 lbs. of milk and 638 lbs. of butterfat.

The Roaring "Sixties" . . .

——finds us looking to the future with high hopes, renewed faith and determination!

The "Fifties" Were Rough . . but did enable us to:

——Convert from grades to purebreds.
——Build more housing and improve facilities.
——Establish a BALANCED breeding and feeding program.
——Find a milking machine that milks cows safely.

We take this opportunity to publicly acknowledge the guidance, encouragement and tremendous help given us in our efforts.

1. **Mr. Lawrence Bouma, Bou-Matic Milkers Inc., Ontario, Calif. THANKS:**
   —for a truly scientific approach to the milking system.
   —for 2½ years research in inflation design.
   —for visible milking.
   —for perfect pulsation.
   —for building it right . . . where it counts.

2. **Mr. Bill Weeks, Rockford, Illinois. THANKS:**
   —for "Animal Analysis Associates."
   —for discovering and developing the REAL secret to a successful breeding program.
   —for a simple, practical key to selective matings.
   —for taking the guess work out of sire selections.

3. **Dr. E. A. Woelffer, Oconomowoc, Wisconsin. THANKS:**
   —for a complete, sensible and practical herd health progam.
   —for taking the guess work out of sterility problems and pregnancy determinations.

4. **Dr. E. E. Pfeiffer of the Biochemical Research Laboratory, Spring Valley, N. Y. THANKS:**
   —for a balanced program of soil and plant nutrition.
   —for high quality feeds.
   —for realizing that our milk comes from the soil . . . not from the cow.

5. **Msgr. N. H. Wegner, Director of Boys Town. THANKS:**
   —for constant encouragement and willingness to 'go along' with all our ideas and our program as it has developed.

These great leaders and our many friends have helped us "ARRIVE" where we are. We will continue with a balanced program which includes . . .

★ **aAa BREEDING** ★ **BOU-MATIC MILKING**

★ **HERD HEALTH THROUGH BALANCED SOIL NUTRITION**

★ We have 100 registered Holstein cows and 100 replacements coming on! Over 60% of these animals cary from 1 to 5 crosses to: Polytechnic Imperial Wayne, V.G. & G.M.

★ Our program will express itself through the blood of POLY and we look to the future with assurance that we can MAKE THE CERTIFICATE OF REGISTRY MEAN MORE!

P. S. STEP NO. 1—PROMOTION: The five best females ever to leave our herd at one time.

SEE THEM AT THE STATE SALE AUGUST 18

BOB STEFFEN, Farm Manager

FATHER FLANAGAN'S BOYS HOME
BOYS TOWN, NEBRASKA

BOB JOHNSON Herdsman

ECHOES OF THE BIO-DYNAMIC CONFERENCE AUGUST 1961 AT THREEFOLD FARM

EVELYN S. GREGG

Besides a generous amount of meaty information, the Conference speakers this summer brought along much enthusiasm and gave us more laughter than usual.

The Annual Meeting the first evening was brief as to business. Then we heard short accounts of what various members are doing on their farms or gardens. The ladies of the Threefold Farm Community kindly served refreshments which we enjoyed as we chatted. Don't miss this first evening when you come next year. It is one of the best chances for seeing old friends and meeting the new folks. There is less opportunity for this between sessions and at meals since many now have to live outside. The Conferences have outgrown the facilities of Threefold Farm and only those who apply early can now find accommodations there.

Mr. Heinz Grotzke opened the Saturday morning session with "Practical Requirements for Seed Production & Selection". Details of this later; likewise of the talks of the two ladies,—Miss Spock, whose talk followed on Saturday and Miss Thomas from Greene Herb Gardens who talked on Sunday, both of special interest. The Question and Answer periods, always bringing unexpected nuggets of knowledge, will be recorded later elsewhere.

Professor Winter's colored slides taken in Russia during his trip last fall, were very fine and together with his amusing story of the wiles used to get to out-of-the-way places, gave us a familiarity with the countryside, since he was especially interested in rural Russia. Professor Winter has now accepted a fine teaching opportunity in Europe, and with all the family, has left the homestead near Nyack. We shall miss them all, but hope that in the future he will use his summer vacations for trips to the U.S.A. instead of in Europe, so that we shall see him often at the B.D. Conference.

Mr. Escher spoke on "Can We Achieve a Healthy Orchard?" Since he makes and distributes the Tree Spray, he has had wide opportunity for observations in orchards, from apples, peaches and almonds to pecans and walnuts. To overcome the general deterioration he sees today he gave suggestions which supplement the general Bio-Dynamic practices found in our leaflets

"Bio-Dynamic Treatment of Fruit Trees, Berries and Shrubs" and "Bio-Dynamic Sprays" (60c each from Mrs. Porter).

For good air drainage and ventilation, locate the orchard on a hillside if possible and then keep tall grass and weeds cut. The best ground covers are Ladino clover, white sweet clover or birdsfoot trefoil. For mice protection put gravel around the trunk for about a foot and on this set a circle of hardware cloth (¼ inch mesh) about 18 inches high and anchor it with stakes. This is especially important winter protection for young trees, but even old trees are sometimes girdled by mice. For such winter damage, the Bio-Dynamic Spray 500 used on the wounded area as soon as the weather is above freezing, will often make the difference between recovery and death of the tree. Use of DDT in orchards inhibits root growth. A good compost for orchards is ½ manure with weeds. Too much manure is not good for fruit trees. There is no known remedy for the disease which leaves little shrivelled and dried fruits on the tree. The only help is to collect these shrivelled fruits *and* brown leaves, and burn them all.

FARM FORESTS

Sunday morning Mr. Piening made us realize that a farmer needs also to be a forester if he is to get the benefits that can come from having tracts of woodland on his farm. On his New York State farm Mr. Piening has gradually rejuvenated his 28 acres of woods by working on 3 acres each winter. Seeing it myself after his first three years of work, I was surprised at the striking contrast between the part he had done and the untouched forest. An impression of orderliness and healthy growth was unmistakable in the controlled area.

What would New York State be without its forests, Mr. Piening asked. They help retain water, control snow drifts, winds, floods and erosion. Yet a comparatively small proportion of its forests are available to orderly cutting. The State totals 311 million acres, 47% of it woodland (including swamps, bare mountain tops and clean cut acres). This 15 million acres of woodland is one fifth State owned and four fifths privately owned. Of the latter, one third belongs to farmers and provides a good source of timber, one seventh of the total. All too often, however, a farmer pays no attention to his woodlot except to cut what wood he wants to use, leaving only the poorest material. Or he may be in financial difficulty and sell his woodlot, which means also that all good trees are taken out. Or cattle may be

allowed to browse there, usually ruining the best trees. Or the whole may be neglected, growing dense and weak in comparative darkness.

The first three years after Mr. Piening bought his farm in 1951, there was no time for the woodlot. Then in 1954 he attended a meeting of the Forest Extension Service and asked the forester to come and talk over his situation. They walked through the woods together, the forester offering advice, marking the trees he thought should come out and explaining why. Mr. Piening then signed up as the first cooperator in the county under the forest practice act. As time allowed all winter he worked on the first three acres, cutting it out mostly for firewood. Sometimes this brush may be sold for pulp, but saving the expense of fuel for the home was as good as income.

The first trees culled were "weed trees" (ironwood or water beech), then those that were crooked, badly-shaped, diseased or injured. Cattle were fenced out except for a small area for their shade. Large open spaces were avoided. Brush growth was left around the edge for wind protection, and a den tree or two for wild life. About 30 to 40 percent of the growth was taken out at the first working. It looked comparatively bare, but many seedlings soon came up. The second winter a chain saw aided the operations. After 5 years each area was gone over again and this was a harvest as well as an improvement cutting. Besides firewood, posts and lumber (to build the new barn) came from the woodlot harvests.

The most valuable trees to keep were black cherry, white ash, soft and hard maple, basswood, oak, hemlock and pine. Those of less value yet not in the "weed" class, were hickory, beech, yellow birch and elm (if not along a creek).

After the fifth 3 acres was done, the forester arranged a demonstration. Everyone could see the stage of development after each year's work. Instruments measuring the radial growth of trees, showed that this had tripled after each improvement cutting.

Does this kind of work pay, you may be asking. Possibly not in the same way as the ordinary cash crop, but over the years there is no question but that it pays. There is very little expense for tools, gas, etc. The main question is how one wants to use the time in winter,—for indoor rest or outdoor forestry? There is mystery and privacy in the forest, and much tradition. It

gives moments of quiet refreshment. You will come to love your forest if you work in it.

Dr. Pfeiffer remarked that nearly 40 years ago in the early days of Bio-Dynamic Conferences abroad, there were always foresters sharing an active interest. The growth pattern of woods was always taught. In this country the foresters were among the first to understand the Bio-Dynamic principles, as applied to forests. In general the same Bio-Dynamic Preparations and practices that make a farm or garden healthy, are also good for the forest. There is one exception,—the use of 501 on young trees, especially evergreens. It stimulates the flowering and fruiting process. Trees being long-lived and slow-growing, cannot stand this too-early urge to maturity. We should take forest management seriously again and help stem the present tide of deterioration. The immigration of birch in this area from the sub-arctic, is such a sign of increasing acidity. If maple and oak continue to be replaced by birch and hemlock and pine, our good forests will be at an end. Conifers and hardwoods are quite different in their effects and we need to make an effort to preserve the latter. There are natural cycles of forest growth. Seven hundred years ago the evergreens dominated in this region as they do now in the northwest. They are gradually coming in here again.

The proper protection of seed trees in a forest that is worked, is a problem not yet solved, but we know that the oak is one of the trees which is a natural protective tree for young growth. If you cut a wooded area clean, little or only inferior growth will come up. If you do not replant at once with trees, the land will dry out and erode. Selective cutting is now recognized as the best practice. Your local forestry agent will be eager to help you with good advice and also to arrange sales if you wish. The government has awakened to the importance of woods to the water supply. In California the water table, once near the surface, is now 800 feet down. If forests are lost, desolation is in progress. Under the trees in a wooded area, there is practically no radio-active fall-out, so trees around a home are good protection.

The content of Dr. Pfeiffer's lecture as given at the Conference will not be reported here as it is largely incorporated in various articles.

Echoes of other Conference lectures will appear later.

TOWARDS HEALTHIER ORCHARDS

PETER A. ESCHER

A few years ago this writer was asked whether he would be willing to make and sell the B. D. Tree Spray for fruit trees. With his fingers crossed, he decided to make up a few batches and see what would happen. Since then the sales have gradually developed. It is now being used in most of the States of the Union, including Hawaii and Alaska, as well as Mexico and Canada, England and Germany. With the growing sales more attention was devoted to plant diseases. Under moist climatic conditions these seem to be more prevalent. Whereas most insects seem to favor dry conditions. Aphids and mites being exceptions.

Some thirty years ago the infestations started to become so serious that even homeowners had to begin to spray in earnest if they wanted to protect crop and tree. In the 1925 Annual Yearbook, the U. S. Department of Agriculture devoted some 150 pages to insect pests and plant diseases. The 1952 and 1953 issues of this same Yearbook were entirely devoted to these problems.

The prevalent thinking in agriculture today is more and more in terms of chemistry. The soils of orchards, well-managed by official standards, are in good shape from the point of view of chemical analysis. The structure of these soils, however, is often in poor shape. The grower protects his trees against disease by repeated spraying. He has to do this regardless of the soil conditions. If his soil is a loam or a heavy loam, that is, contains a good bit of clay, spraying during a wet Spring compacts the soil. Ruts as much as 9″ deep have been observed in orchards. This does not help the drainage any. Growers seem to be unaware of this condition. To overcome it, it is necessary to plant a cover crop that is deep-rooting, sweet clover for instance. Sweet clover is generally considered to be a southerly plant, but has been seen growing in Central Ontario.

Generally, the feeder roots of apple trees are under the drip line. Some types of shallow rooted stock, however, extend their roots well beyond the drip line. The heavy machinery used for spraying can also make life difficult for these feeder roots. In other words, spraying under wet conditions can be very harmful.

The size of orchard or grove has a tendency to increase due to the wage problem and the investment in machinery, which is

ever-increasing. Commercial spray-rigs could handle but a few acres before the last war. Today they have increased in size to the extent that the labor requirements have been reduced to a minimum. The main chores that still require hand work are pruning and harvesting.

The expense of spraying weighs heavily on the shoulders of the grower — or operator which he so often has become. The problem is to develop countermeasures, which will ease the burden of a heavy spray bill. Again and again it has to be mentioned, that the soil structure and the soil life must be fostered. Why create an unhealthy environment and encourage pests? The thinking in many parts today is to develop varieties of plants resistant to disease. A lot of valuable work has been done in this respect both for field, vegetable and fruit-crop plants. However, this is only one aspect.

Today the spray manufacturing industry is thoroughly established and has a high cost of distribution and research. In Nova Scotia for instance, the apple growers found that they could not export their fruit to the French and British markets due to the high amount of spray residue. Quite a few of the orchards there have resorted to using less poisonous sprays without reducing the number of sprayings. Good results have been obtained by using as little as 3% of the sprays currently recommended. The spray industry in the U.S. sells well over $100,000,000 a year and has increased some 40% in the past 4 years.

There are many remedies which have to be used. Some are too well known to be remembered such as the birds. It is true, they dc not eat all the pests. At least they keep them down. Old trees are generally cut down thus depriving them of nesting places. Nests for wrens will have to be provided. Birds may have to be fed especially in early Spring, when they need it most. A lot of work has been done in biological control. The basis of course is to encourage the local predators. Some of these have been pretty well exterminated by the current spray programs. A fruit grower recently mentioned ten major insect pests, which bother his orchard. Three of them were caused by exterminating the predators with DDT.

Indeed the sprays used today do not leave as long-lasting residues as the arsenates and leads do, which were used predominantly in former days. Nevertheless little work is being done to overcome the ill effects of the residue on plant and tree. This can be reduced with a better soil life and a soil stimulated by

bacteria and enzymes. After all, if we have the choice of entering a room with a pleasant odor or one with an unpleasant odor, we have enough sense to choose the former. Why not think of the plant in terms of its environment and create an environment the plants like? We have to face it. With the present economic conditions as they are, monoculture is an established fact. The problem, therefore is not to deny it, but to use and develop ways and means to help the plants.

Hand in hand with the soil life goes the cultivation of the soil. In an orchard a soil can either be in sod, which is necessary on a steep hill, or it can be mulched, which is desirable under climatic conditions apt to cause a drying out. The other means is to cultivate the soil with cover crops.

A heavy sod can cause a heavy layer, which does not permit the roots to penetrate farther down. The roots of the trees are then deprived of sufficient air. On a hill side it may be possible to disk the sod lightly and it should be cultivated with a rotary hoe in Fall to penetrate the heavy layer of sod and let the deep-rooted plants establish themselves.

In some places the grass is cut and used as a mulch. In order to prevent too much moisture the mulch may have to be worked into the soil and the B. D. Field Spray applied to assure a proper breakdown. Scab is spread by the spores which are on fallen leaves and apples. These spores will develop in Spring and spread to the trees. The leaves cannot possibly be raked in a large orchard but should be worked into the ground. This will bring about a quicker breakdown of the leaves.

In some cases open cultivation is practiced, throughout the year. This may cause washing of the soil and wind erosion. A cover crop in late Summer helps to overcome this. A mixture of grasses (perennial Rye) and clovers are generally used. Care should be taken to assure, that at least some of the roots penetrate deeply. Soil drainage is most important. Water is of no help if it does not penetrate the soil. It only makes it harder to cultivate. If the grower has to spray on a soil that is too moist, the condition is aggravated.

In the East our Springs are moist or sometimes downright wet. We have to assure thorough ventilation. The surrounding hedgerows should not be too dense or too high to permit the air to move, even when there is but a slight breeze. A heavy fence row or a wood lot can prevent adequate air drainage. You can observe the mist collecting at the bottom of an orchard and later

note a nice collection of scab, or further on in the season aphids aplenty on the new growth. This requires additional spraying, with an additional hole in the pocketbook.

In case of scab the sod should be kept mowed and the branches should be pruned say to three feet above the ground to allow air circulation. The trees may have to be pruned with the object of better aeration in mind.

The attention of people today seems to be completely captured by the idea of killing insects and eradicating disease. Little attention is being paid to prophylactic means. The B. D. Tree Spray should be applied in Fall after the leaves have dropped or after they have turned brown. The idea is to cover the bark of trunk and branch and twig. The crotches in particular should be sprayed to prevent insects from hibernating and to prevent them from emerging in Spring.

The commercial apple grower in the East in Spring has to contend with scab as his worst infestation. As mentioned above scab*, a fungus, hibernates on the fallen leaves. The spores are carried to the tree and attack the young growth. For the primary infection it is necessary for the leaves to be wet for a period of 30 hours at a temperature of 40° F. At 49° F. the length of time is reduced to 14 hours, at 65° F. to 9 hours. In Ontario the infestation seems to be quicker. At 42° F. it takes only 20 hours for the primary infection. The difference tapers down as the temperature increases. The first spray the commercial grower has to apply is the dormant spray, followed by the prepink, when the first green tissues show, bloom, petal fall. These applications are against scab. The first, second and third cover after petal fall follow each other by a week. These are against scab, curculio and codling moth. The fourth to the eighth cover are applied about every two weeks. They are to protect against the secondary scab infection, codling moths and apple maggot. For other fruit the grower faces a similar problem. It may not be as acute. But he does have to spray at the right moment, or risk losing his crop.

The problem in this spray program is to protect the new growth against scab infection. The B. D. Tree Spray does stick longer to the plants, but that does not help the new growth. With that in view a different spray is being developed specifically against scab, for commercial growers. It is less expensive but

* The following technical details are quoted from MODERN FRUIT SCIENCE by Norman F. Childers. HORTICULTURAL PUBLICATIONS, Rutgers, Nichol Ave., New Brunswick, N. J. 1961.

designed specifically for the purpose of disease control. The problem of the B. D. Tree Spray, or any other spray is, that it be economical. In other words, that it costs the grower no more to use, or preferably less, other factors being equal. The other factors are such as proper care of the orchard, which should be taken anyhow. Contrary to the impressions of some people we have not discovered any other general simple solution to these problems, than hard work.

Two apple orchards have been observed this past season. Each has about 1,000 apple trees. Both have used the B. D. Tree Spray for the first year. One is in Ontario, Canada, while the other is located in New England. The following outlines give descriptions of both places and observations concerning their problems.

	Ontario	New England
Location	hillside facing Southwest	top of hill
Drainage, both excellent	a few trees near bottom land	except a few wet spots
Topsoil	black earth and loam	loam
Subsoil	gravel	slate horizontal
Cultivation	open till Aug. 1st. then cover crop rye grass, sweet clover	in sod mowed cultivation around trees first year cover crop second year.
Fertilization	manure from the farm	commercial compost
Tools for cultivation	Graham chisel plow disk	bog harrow rototiller.
Mice	some damage, ringed trees admirably grafted	mice under sod mulch baited, little damage.
	both should put gravel in a 1 foot circle around trees.	
Rabbits	both little damage.	
Mulching		young trees. protected to some extent by wire nets. baiting most important.
Major infestation	well controlled little damage.	infestation due to insufficient
Scab	Effectiveness of B.D. Tree Spray about the same as a fungicide widely used.	spraying in spring
Insects	practically complete control	some due to insufficient and improper spraying.
Pruning	under control	insufficient, due to new ownership and neglect by previous owner

Growth	stocky	somewhat too much, due to heavy application of nitrogen fertilizer by previous owner.
Apples	not tasted	last year's apples under previous management very large, beautiful but inedible and poor eating quality due to too heavy nitrate application. This year somewhat smaller fruit, better tasting. Better keepers.

We have to keep in mind, that the homeowner tries to spray as few times as possible, whereas the commercial grower has the equipment ready to go and is prepared to spray, whenever necessary. In other words he does not particularly mind spraying repeatedly. He either does the work himself or has hired labor, whom he has to pay anyhow. The use of the equipment does not enter too much. After a few years his gear is outmoded anyhow by new and more efficient machines. The trend may well be toward heavier sprays with the result, that the spray equipment will have to be redesigned for a spray apparatus that can handle a higher percentage of solid matter.

The homeowner with a small orchard or with a few trees faces basically the same problems as those which confront the grower with several hundred trees. Labor is more readily available or can be spread to undertake more thorough control measures. In an orchard with 1,000 trees it takes many birds to keep the insects down. Whereas in a small orchard, this sort of control can be more readily achieved.

A homeowner does not mind spending more per bushel of his harvest. He would otherwise have to purchase the apples in the market at retail prices. This is a different matter for the large grower. He has to sell at wholesale prices. If he is able to sell retail, he still has the expense of selling. That is not an easy problem. As orchards are starting to produce a better quality fruit and as some of it will gradually become actually biodynamic, the problem of marketing becomes acute. After all, for a better quality a grower should be able to receive a better price. The differential should by no means be exorbitant, say in the neighborhood of 15% - 20%. The consumers exist. The problem is that of contacting them. This is probably the weakest part of the movement, be it Bio-Dynamic, N.F.A. or organic.

After all the proof of the pudding is in the eating. The consumption of apples has not kept pace with the growth of the

citrus industry. Citrus fruit does not have to be sprayed as much. On the other hand people are reluctant to eat many apples, when they taste the spray while eating an apple. The statistics of relative fruit consumption are for the country as a whole. In other words there are many people who do not like the quality of apples of today. Most of these people have never heard of any movement to grow better fruit or vegetables or any other farm crop, or farm stock. These people are not interested in fanaticism or in opinions. They simply want to get the best quality food they can at a reasonable price. To reach these people is the problem we have to face squarely.

$2,000

Two thousand dollars is not, under present conditions, very often a sum of great public importance. Yet for the future of Biodynamics, and other scientific fields dealt with by the Biochemical Research Laboratory it is a figure of real and continuing significance.

These paragraphs were prompted by some remarks of Dr. Pfeiffer at a recent meeting of the directors of the B.D. Association. Referring to the laboratory's chronically hand-to-mouth existence, he explained how the research projects are carried on.

Whenever its bank balance is over $2,000 — the minimum necessary to insure the small salaries for which his devoted assistants are willing to work and to meet other necessary expenses — various important investigations can continue, alongside the soil testing, etc., from which there is a little income. As soon as the account falls below this point current research has to be dropped until the balance can be built up again.

It occurred to the undersigned to pass this information along to the readers of Bio-Dynamics. For here there is, literally, an opportunity to make a little go a long way. A lot of regular *small* contributions can certainly help to keep that bank balance so modestly healthy (need we add that large ones can do even more?). Just in case anyone doesn't know it, we might add in closing that gifts to the B.D. Association, earmarked for the laboratory's research, are income tax-deductible.

F.H.

CHALLENGE TO MATERIALISM

"Animal Husbandry Heresies," by Allan Fraser, M.D., D.Sc., (Lecturer in Animal and Dairy Husbandry, University of Aberdeen). Published in U.S.A. 1961 by Philosophical Library. Two hundred pages, $6.00.

A reader of Dr. Fraser's book must envy the students in his university classes. He has the gift of making serious, scientific subject matter sparkle. And this, let it be emphasized, without any loss of earnestness or scientific dignity. Usually, in reading for a review, there just isn't time for thorough scanning of every line. But this book is, or, one had better say, 'we found it to be', so engrossing, that one felt one cheated oneself by any mere skimming.

What the author has to say is not only interesting, but definitely important. The man has worked too long in the practical (as well as theoretical) aspects of animal husbandry, to take the sometimes dogmatic claims of science (genetics, for instance) too seriously. And he always has evidence for his "heresies". Pointing, for example, to the practical stock breeder, who has gotten excellent results without any clear distinction in his mind between the influences of breeding, feeding and general good farming practices (husbandry, they call it), he suggests in consequence that it would be a good idea for the scientist to go occasionally to the farmyard "to learn rather than to teach or, what is far less excusable, to preach."

"Modern science, however," Dr. Fraser continues, "with its concepts derived from that particular system of philosophy called vulgar materialism and founded historically on the industrial revolution, has a different approach. The philosophy of science is that all natural phenomena, were they fully understood, are reducible to the terms of chemistry and physics; that the only difference between a crystal and a man is one of complexity not of kind; that there is no fundamental distinction between things living and things dead, between body and mind or mind and soul. With the philosophical implications of that approach I am incompetent to deal, not being by training a philosopher. Nevertheless, it must be accepted that unless that materialistic outlook be a true one, then science in its present form must eventually prove an untrustworthy guide to the study of any living thing, be it animal or plant. It would be an untrustworthy guide to agriculture in general and to animal husbandry in particular."

He emphasizes that he would not "turn the clock back," feels that mechanization, "advancing rapidly in soil cultivation and crop husbandry" will also be inevitable in animal husbandry (citing what has already happened in chicken and egg production) and therefore the nutritionist (animal and human) and the veterinary, simply must face and solve the new problems raised.

His conclusion, propounded in the last chapter, is that the main purpose of animal husbandry is to provide "protective foods" to balance human diets, and hence "it is quite wrong that the health value of any food should ever be sacrificed merely to suit a commercial convenience." He illustrates what he means by various examples, eggs for instance, where the eggs for human consumption are from hens fed "layers' mash" although, since these will not sustain the baby chick for its weeks in the shell, the breeding hens have to be given a "layers' mash" that includes certain essential dietary factors lacking in the other. He comments:

"There is a growing suspicion that while modern agriculture produces more food, that food is not of such high health value as that produced under older and more natural conditions. The Biodynamic School which emphasizes a supposed superiority of dung and compost over chemical manures with reference to the health value of the vegetable and animal food produced is one clearly audible protest, but there may be others, less audible. The average consumer cannot be altogether happy concerning the extent to which poisonous substances are being so freely used as weedicides, insecticides and for similar agricultural purposes. To the average citizen the formulæ of the majority of these substances can mean little or nothing, but arsenic is arsenic to anyone conversant with detective fiction".

At this point one is impelled to depart from mere passive "reviewing" to point out that Dr. Fraser or anyone else sufficiently interested to follow the matter up could discover that published research of the "Biodynamic School", notably that of Dr. Pfeiffer, has clearly demonstrated that properly prepared composts, of animal or vegetable origin have a good deal more than a "supposed superiority" over "chemical manures". And to point out further that Biodynamics at the same time takes no fanatical position on the matter and will always make whatever provision is necessary where a soil is shown to be deficient in needful chemical elements.

In fairness to the author, it must be emphasized that he himself does his best to avoid fanaticism in any direction. He is interested in *facts,* and does his best throughout to deflate those who build up unwarrantable *theoretical conclusions* on the basis of certain observed facts and then promulgate these as "science". The world could do with more like him.

Exegesis, which in practice amounts to lifting things out of their context, is always unfair to a writer, so one must refrain from quoting various isolated bits since the limitations of space prevent full development here of the related materials. One thinks for instance of his demonstration of the practical husbandry value of the practice of the Palestinian shepherds whom he observed, still to this day, "leading" by blowing on their pipes, the herds that we in the West "drive" via the trained sheep dog who starts with "the wide circling run which is so attractive to witness at sheep-dog trials but which is, essentially, the first gambit of the wolf in gathering the flock for the pack to devour.

"From every possible point of view, physiological, psychological and obstetrical, it is obviously preferable to lead sheep rather than to drive them, even although to lead is ancient and it is rather more modern to drive."

Were there any criticism of Dr. Fraser's most valuable and challenging book, it might be in connection with his at least seeming over-emphasis on the effects of feeding and sound farming practices, i.e. environment, as against heredity. Our good friend Dr. Winter who is both a college professor and a highly successful Biodynamic homesteader, commented when we were discussing the book recently, that "the truth probably lies somewhere in between". He based this on his experiences with "purebred" and grade goats, all in a nearly ideal B.D. environment, where the former consistently out-performed the latter. The reviewer's own experiences with goats were along the same lines.

FRED HECKEL

EDEN REVISITED

Gardening Without Work (subtitled) For the Aging, the Busy & the Indolent. By Ruth Stout, May, 1961, by The Devin-Adair Co. 214 pages, $3.95 per copy.

And well worth the price, for it sums up years of practical experience with mulching in the vegetable and flower garden. Also, it is clear that no right-minded person can quarrel with the

well-taken point that many persons who are too old or ill to garden by more "conventional" organic methods are, by the "Stout System," enabled to have and enjoy a garden and its produce. A good case can even be made for luring "the Indolent" out of doors, and, as an end result, giving them the taste of other than commercially-grown vegetables.

One feels some qualms when the lady quotes her good friend Professor Richard V. Clemence who, after citing "Sir Albert Howard and his famous compost heaps", pays a tribute to him, and to composting and then adds "But many organic gardeners now consider the compost heap to be an outmoded device so far as their gardens are concerned. Superior techniques have been available to the average gardener for some time, and except in special circumstances, the compost heap is no longer in favor".

We have not meant to make a mystery of the topic of this delightfully written book: essentially it recounts 13 years of experience in gardening with mulches alone, year-round, thick mulches, based on spoiled hay (thick enough so that no seeds sprout) with cotton seed meal (five pounds per hundred square feet) put on every winter, as well as the winter's kitchen garbage, and garden refuse as it originates. One gathers that the mulch is never removed. For planting one simply draws it aside from the row and makes a tiny furrow in the earth. Many seeds are left to sprout under mulch left thin enough to make this feasible. There is no crop rotation and no cultivation of any kind.

Miss Stout avoids making any kind of "claims." As she is surely entitled to do, she quotes visiting professors of agriculture who have found her soil "well supplied with all major plant nutrients . . . and the pH value just about perfect".

So, in her opinion, a thick year-round mulch is definitely a good thing. This is her idea on the subject, based on the experience of herself and others.

Our idea, also based on the practical experiences of quite a number of people over a period of years, is that a thick mulch is alright to cut out weeds, but that it brings with it dangers of soil acidity, particularly in a wet year, and cuts the access of air and nitrogen to the plant roots.

Here it must be added that Miss Stout urges anyone using her approach to gardening to have their soil regularly tested by the County Agent for acidity. So it is fair to assume that she has considered the possibility of this danger.

Bio-dynamic experience with mulching is summed up in an article by Dr. Pfeiffer; "MULCHING — Right or Wrong?" in the Summer 1959 issue of this quarterly, Number 51. And the experiences of various growers in the past 2 years have only substantiated the conclusions and practical suggestions regarding various types of mulches brought together there. That we are far from being "against" this aid to gardening is made clear at the end of the article, where the author says:

"To sum up: mulching — yes, by all means, but with the use of good common sense."

To conclude this brief review — I find I have offered no explanation of the title, and should state that it came into my mind after concluding a thorough reading of Miss Stout's charming book. Not only her incontrovertible reference to the fact that "God invented mulching" but the mood of her writing, the feel she evokes of her delightful, almost workless garden, all recall the time before the command was issued, "In the sweat of thy face shalt thou eat bread".

F.H.

HEINZ GROTZKE IN NEW POST

After six years at Golden Acres Farm, Newtown, Penna., Heinz Grotzke, well-known to all friends of Biodynamics, is transferring to a new position at Greene Herb Gardens, Greene, Rhode Island.

In a tribute to Mr. Grotzke, in the *Golden Acres News Letter,* Russel Keep commented that in the time he had been there "each year has seen new contributions from him. . . . To say that Heinz cannot be replaced is self-evident."

Miss Margaret E. Thomas of the Greene Herb Gardens said:

"Heinz Grotzke has joined the Greene Herb Garden Family in Greene, Rhode Island. His knowledge of Biodynamics will be put into practice this fall, when he will prepare several acres for spring planting. Mr. Grotzke will introduce three new herb products to be placed on the market this coming year."

Commenting that "we are really looking forward to his being with us", Miss Thomas added, "At the same time we trust that Golden Acres will continue successfully to provide biodynamic products to an ever increasing clientele."

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